DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON

(Revised February 25, 1926)

SPECIFICATIONS FOR PORTABLE AUXILIARY GENERATOR, BUREAU OF STANDARDS TYPE O.

This radio-frequency generator is a type which was originally designed by the Bureau of Standards for use by the radio inspectors of this Department. The specifications are in a form suitable for use by a manufacturer. It is estimated that the generator can be manufactured for approximately $140 to $180. The user will have to provide in addition a pair of head phones, 4 No.6 dry cells (or a 6-volt storage battery), 4 B-batteries, (each 22 1/2 volts), and one electron tube, UV-201A or equivalent. The Bureau of Standards does not manufacture or sell this or any other device.

The Bureau of Standards has made no investigation of the possible existence of patents covering any of the features of these specifications, and takes no responsibility for their freedom from patent infringement.

Uses.- This generator is designed primarily for use in conjunction with a piezo oscillator for frequency calibration of frequency meters and other apparatus. Specifications for a piezo oscillator are given in Bureau of Standards Letter Circular No. 186, "Specifications for Portable Piezo Oscillator, Bureau of Standards Type N." Directions for the use of the apparatus are given in Bureau of Standards Letter Circular No.183, "Directions for Use of the Piezo Oscillator and Auxiliary Generator for Calibration of a Radio Frequency Meter." As explained in that Letter Circular, this combination of apparatus gives a remarkably convenient and rapid means of calibrating any frequency meter throughout the whole frequency range from 18 kilocycles to 10,000 kilocycles (17,000 to 30 meters).

The generator is also useful, in conjunction with a receiving set, to standardize a frequency meter by means of waves of known frequency, such as the Bureau's standard frequency signals or the standard frequency stations. It may also be used, conversely, as an adjunct in measuring the frequencies of received waves from stations at a distance. Information on these uses is given in Bureau of Standards Letter Circular 171, "Methods and Apparatus for Measurement of the Frequencies of Distant Radio Transmitting Stations."

Calibration.- It is desirable that the generator be approximately calibrated, so that the user can quickly set for a desired frequency. The calibration, however, will not remain constant to high accuracy, and the apparatus can not be relied on as a frequency standard. The calibration can be made from any frequency meter, or from the Bureau's standard frequency signals or

the standard frequency stations. Information regarding the latter is given each month in the Radio Service Bulletin, a monthly publication of the Department of Commerce, obtainable by purchase from the Superintendent of Documents, Government Printing Office, Washington, D.C., at 25 cents per year. Letter Circular 171, previously mentioned, explains how an unlimited number of points for calibration may be obtained by the use of harmonics from one or more known frequency values.

Auxiliary generators made according to these specifications should not be sent to the Bureau of Standards, as the Bureau will not calibrate them.

General Design.- The purpose of this generator is to supply voltages for measurement work at frequencies from 18 kilocycles to 10,000 kilocycles (17,000 to 30 meters). The tuned circuit consists of a 0.001 μf variable air condenser, with a slow-motion device, in parallel with a coil whose center tap connects to the positive end of the filament. One terminal leads through a milliammeter to the grid, and the other terminal through a telephone receiver and the B battery to the plate. The milliammeter is by-passed by a 0.005 μf condenser and the series combination of the telephone receiver and the B battery by a 0.01 μf condenser. There are seven coils, any one of which can be used in the circuit. The overlap is chosen such that the maximum condenser setting of one coil gives approximately the same frequency as the condenser setting of 15 divisions for the next larger coil. The ratio of the useful maximum frequency to the minimum frequency is about 2.5.

The various parts of the outfit, scheme of connections, etc., are shown on the drawings, which are considered as parts of these specifications (see paragraph on "Drawings" at end hereof). Workmanship and materials throughout shall be of the best grade.

Connections, Panel, Etc.- Fig.1 gives a top view of the auxiliary generator with the cover of the box removed (Fig.4). It shows the knob (8) of the filament rheostat (6 to 10 ohms), which in the "OFF"position opens the filament circuit, the dial (10) of the variable air condenser, and the milliammeter (9); this is a Weston Model 301, or equivalent, requiring 1.5 milliamperes for full-scale deflection The various coils fit in three small sockets (7), General Radio Co. Type 247-J, or equivalent. A standard tube socket (11) is mounted underneath the panel such that two flat-head screws which are countersunk are seen on top of the panel. The panel is of material of the bakelite type. It is shown in Fig.2, and is mounted in the box as shown in Fig.3. Flat-head screws, (4), countersunk, are used for holding the panel against the brass blocks (3) and for holding blocks in place in the box. The holes shown for the mounting of the apparatus are for specific makes. If other apparatus is used it may require changes in these holes.

Fig.5 shows the electrical connections and the various parts mounted underneath the panel. (9) is the milliammeter which is bypassed by a fixed mica condenser (13), 0.005 μf capacity. (18) is the same type of condenser, 0.01 μf capacity connected from

the positive terminal of the B-battery to one terminal of the telephone receiver as indicated.

Condenser.- The variable air condenser (12) shall have a maximum capacity of 0.001 μf and a minimum capacity not greater than 0.00002 μf. A condenser having maximum and minimum capacities different from these values will not give a satisfactory overlap with the specified coils. The condenser shall be equipped with a dial that will give a ratio of dial movement to condenser movement of 80 to 1 or greater. (See note at end of next paragraph about metal part which must fit this dial.)

Fig.4 shows the extension handle used on the dial (10) of the variable condenser (12). This device slips over the slow motion knob of the condenser. The purpose of this extension is to minimize the effect of the hand on the frequency of the generator while adjusting it. This is of importance when working at the higher frequencies. Fig.4 shows the extension handle held in a spring holder (Fig.6) which is mounted inside and along the diagonal of the cover of the apparatus as shown in the drawing. The handle and spring shall not interfere with any of the apparatus on the panel when the cover is closed on the box. The rod and knob of the handle are made of bakelite, and the part which clamps onto the dial, which is shown to the right of Fig.4, is made of brass which is to be nickel-plated. The dimensions of this metal part must be such as to fit the particular condenser dial onto which it clamps.

Coils.- Coils 1, 2 and 3 are single-layer, close-wound coils as specified on the drawings. Coils 4, 5, 6 and 7 are multilayer coils and wound as specified on drawings, Figs.10 to 13. It will be noted that all coils have the same core diameter, 3 1/4 in., and that the length of the core is likewise the same for all coils, namely 1 1/2 in. All coils are wound in such a way that a tap is taken off at their center which leads to a terminal which is denoted by B. The two halves of the multilayer coils are wound as two separate windings, and the point at which they are connected together forms the tap B. The other two terminals are in each case A and C, respectively. These leads which shall be fastened to the coil form must be permanently soldered to the respective plugs of the coil box as designated in Fig.7. The coils shall be wound as is indicated in the drawings with collodion used as a binder. It has been found that the windings required can be readily carried out, and that with the collodion as a binder they form rigid coils. The wire sizes stated are AWG (B & S). The frequency ranges of the coils are: Coil 1 (10,000 kc to 2700 kc), Coil 2 (3000 kc to 1000 kc), Coil 3 (1200 kc to 450 kc), Coil 4 (500 kc to 200 kc), Coil 5 (220 kc to 75 kc), Coil 6 (90 kc to 33 kc), Coil 7 (46kc to 18 kc).

Coil Boxes.- Fig.7 shows the design of the seven wooden boxes which enclose the coils. The coils are wound on bakelite tubing 3 1/4 in. outside diameter and 1 1/2 in. in length. This tubing shall be given a press fit on the circular wooden core and shall be prevented from slipping in the case by means of a strip

of felt between the cover of the box and the coil. No metal is to be used in the construction or securing of the coil forms. The three terminals which come from the respective ends of the coil and its center tap, lead to three plugs as indicated in the Figure. These plugs are arranged on a bakelite panel as shown on one of the representations of Fig.7. On the side of the coil box, which when mounted is adjacent to the outside of the generator box, provision is made for holding the calibration curve, as indicated in the drawing (Fig.8). The calibration sheets are mounted by means of a nickel-plated brass frame of two sections and a clear celluloid cover.

Assembly.- The various parts shall be securely fastened in position. All binding posts, binding nuts, etc., shall be tightened and soldered in position. Fixed mica condensers can be supported between connecting wires. All connecting wires must be bare and self-supporting and of a size not less than No.14 AWG (B&S). All wire shall be tinned or nickel-plated copper and all binding posts shall be of nickel-plated brass. No soldering flux showing acid reaction shall be used, and all excess flux must be removed.

Cabinets.- The apparatus shall be housed in a well-seasoned baywood or walnut wood box. The thickness of the material shall be 1/2 in., and all joints shall preferably be dovetailed. The cover shall be equipped with separable hinges (see Fig.1). The top shall have a handle for carrying. Two clasps shall be provided to hold the cover positively shut when the device is carried. No lock with key shall be used. The under side of cabinet shall be provided with four rubber shock absorbers.

An additional cabinet for holding the seven coils shall also be furnished. It shall be of the same material and finish, etc., and provided with a hinged cover with clasps and a handle centrally located on top of the cover. Details are shown in Fig.9. Aluminum partitions shall be mounted in the box in order to keep the coils in their proper positions.

Finish.- All exposed metal parts shall be heavily nickel-plated, bright finish, except some parts (milliammeter, etc.) which are finished in black. The generator cabinet, the coil cabinet, and the seven coil boxes shall be stained somewhat darker than the natural color of the wood used, and given at least two coats of a satisfactory rubbing varnish.

Marking.- As indicated in Fig.1, the following is to be engraved on top of the panel -

"COIL" in the space between the three coil jacks.

"A-6V" in the space between the corresponding binding posts with a "plus" and "minus" sign as indicated in the figure.

"B-80V" in the space between the corresponding binding posts with a "plus" and "minus" sign as indicated in the drawing.

"TEL" as indicated in the figure.

A hair line as indicated in the figure next to the dial of the condenser.

A curved arrow and the inscripts "ON" and "OFF" properly located to indicate the "On" and "Off" position of the filament current.

On the individual coil boxes between the plugs shall be engraved Coil 1, Coil 2, etc., corresponding to the coil enclosed.

An auxiliary generator made in accordance with these specifications may have engraved in a suitable space, "Auxiliary Generator, Bureau of Standards Type O," followed by the name of the maker.

Drawings.- Radio Nos.1010-A, B, C, D, E, giving Figs.1 to 13, may be obtained by anyone actually requiring them for construction of this device, upon application addressed to Bureau of Standards, Washington, D.C.

Department of Commerce,
Washington, D.C.

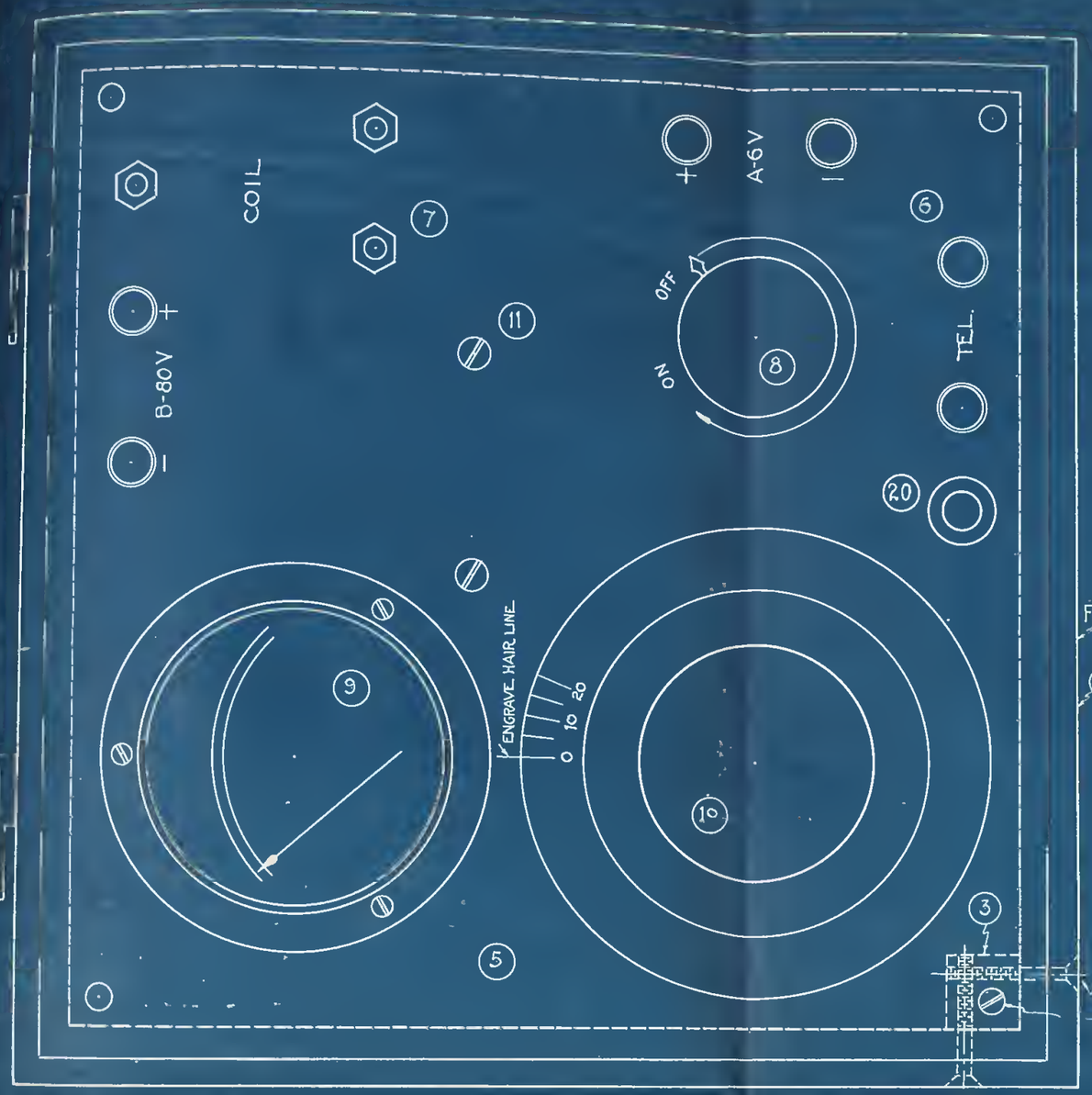


FIG 1

FIG. 2.

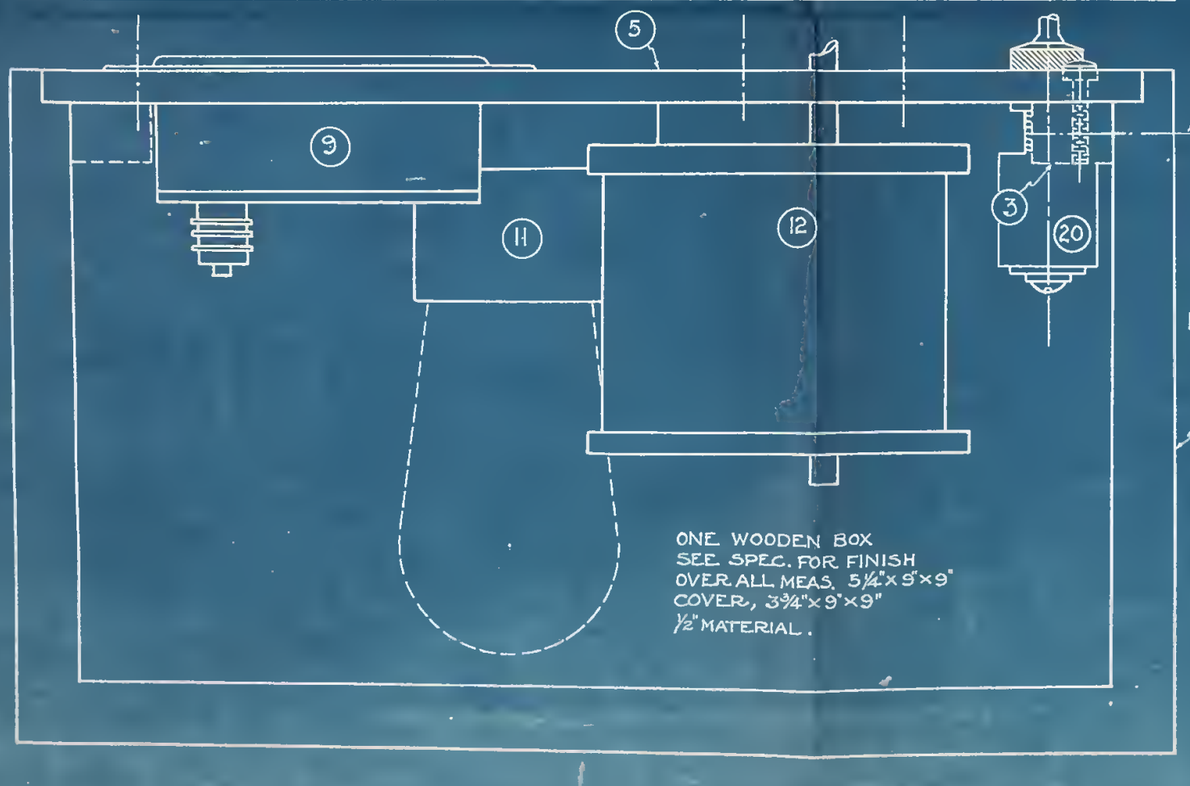


FIG. 3.

1	1	Box	Wood	
2	1	Cover for Box	"	Sheet 2.
3	4	Blocks	Brass	
4	12	Screws	"	
5	1	Panel	Bakelite	
6	6	Binding Posts	Brass	
7	3	Terminal Jacks		
8	1	Rheostat		
9	1	Milliampere		
10	1	Dial		
11	1	Socket		
12	1	Var. Condenser		0.001 μf
13	1	Fixed "		0.005 μf
14	1	Handle-Knob-Axle	Insulation: Brass	Sheet 2.
15	2	Spring Catches		Phos. Bronze. Sheet 2.
16	7	Frames	Brass	" 3.
17	1	Coil Box	Wood	" 3.
18	1	Fixed Condenser		0.01 μf " 2.
19	1	Box & Cover	Wood	" 3.
20	1	Filament Switch		

BUREAU OF STANDARDS WASHINGTON, D. C.	DRAWN A.G.J.	SCALE	AUXILIARY GENERATOR
	TRACED K.J.C.	DATE NOV. 30 25	
	CHECKED C.E.H.	DRAWING NO. 1010A	
DIVISION 1 SECTION 6	APPROVED J.H.D.		NO. SHEETS 5 SHEET NO. 1

FIG. 4.

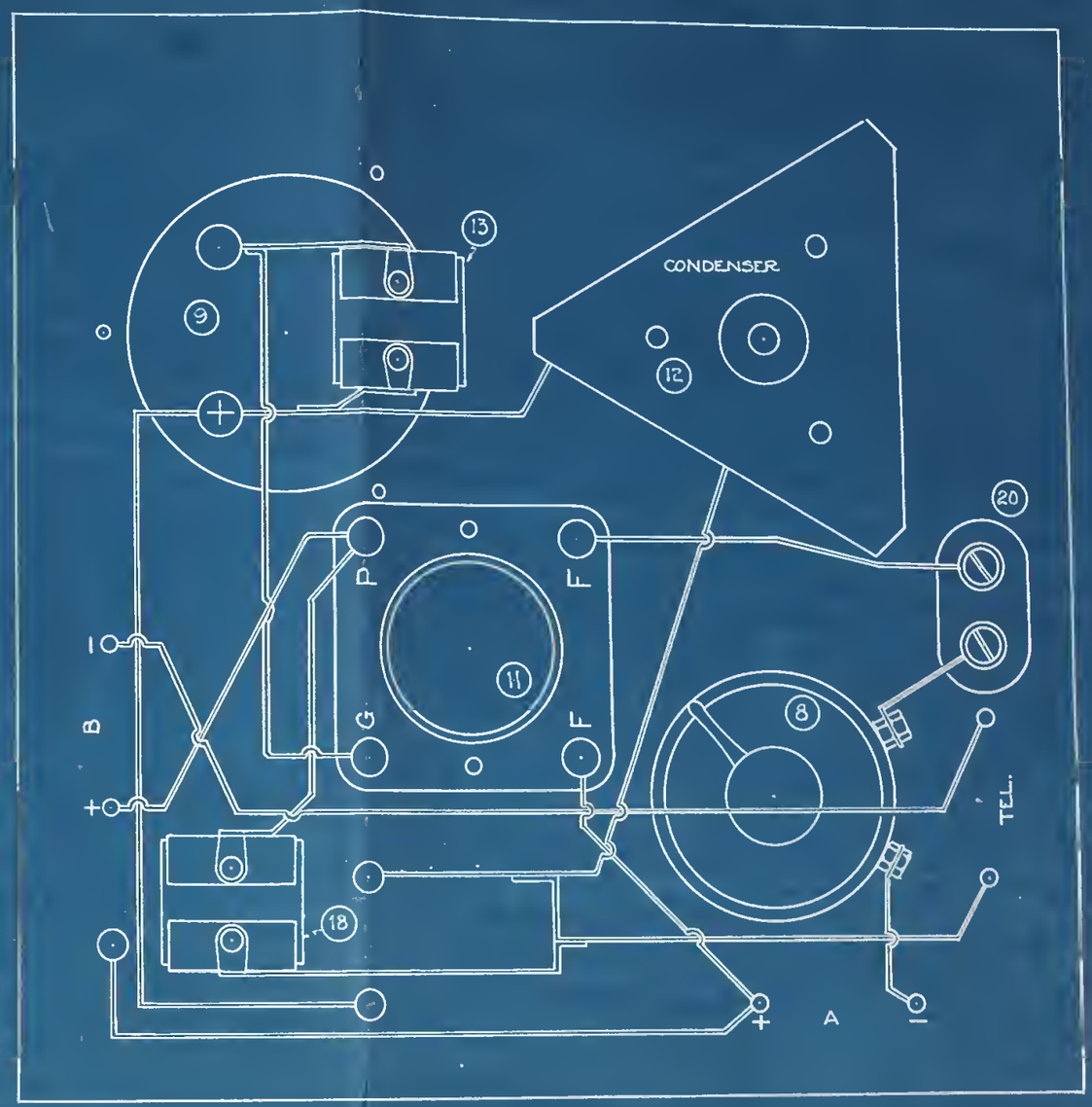


FIG. 5.

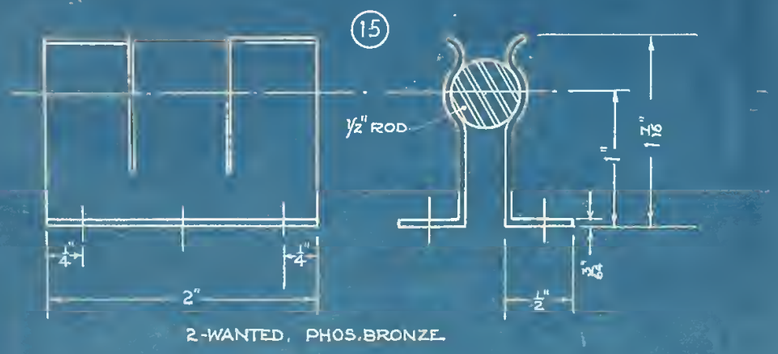


FIG. 6.

BUREAU OF STANDARDS WASHINGTON, D. C.	DRAWN J.K.S.	SCALE	AUXILIARY GENERATOR
	TRACED K.O.G.	DATE DEC. 9. 25	
	CHECKED	DRAWING NO. 1010-B	
DIVISION 1 SECTION 6	APPROVED	NO. SHEETS 5	SHEET NO. 2

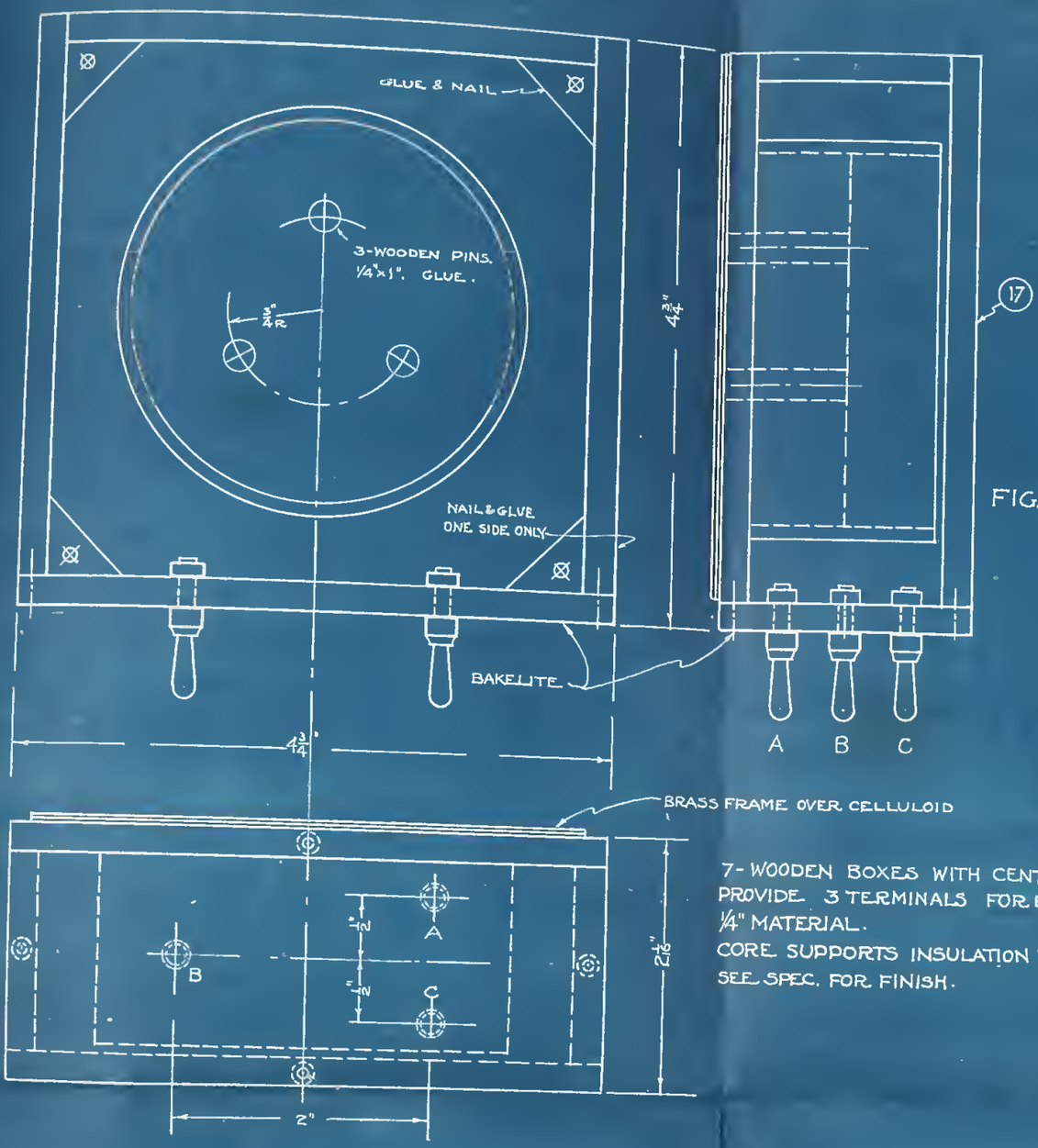


FIG. 7.

7-WOODEN BOXES WITH CENTER CORE
PROVIDE 3 TERMINALS FOR EACH BOX
1/4" MATERIAL.
CORE SUPPORTS INSULATION TUBE
SEE SPEC. FOR FINISH.

COILS 1, 2 AND 3. ARE SINGLE LAYER WOUND ON CORE 3¼" DIA. BY 1½" LONG.

COIL 1,	2 BY 2 TURNS.	NO. 16.	D.C.C. WIRE.
" 2,	2 " 7 "	NO. 16.	" " .
" 3,	2 " 18 "	NO. 24.	" " .

FIG. 8.

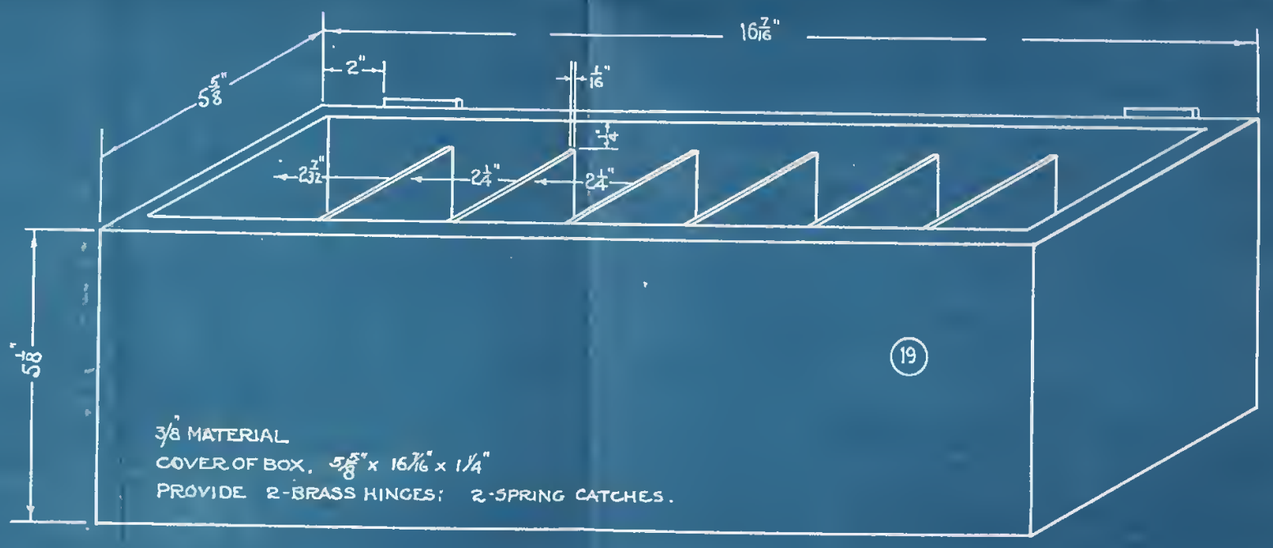
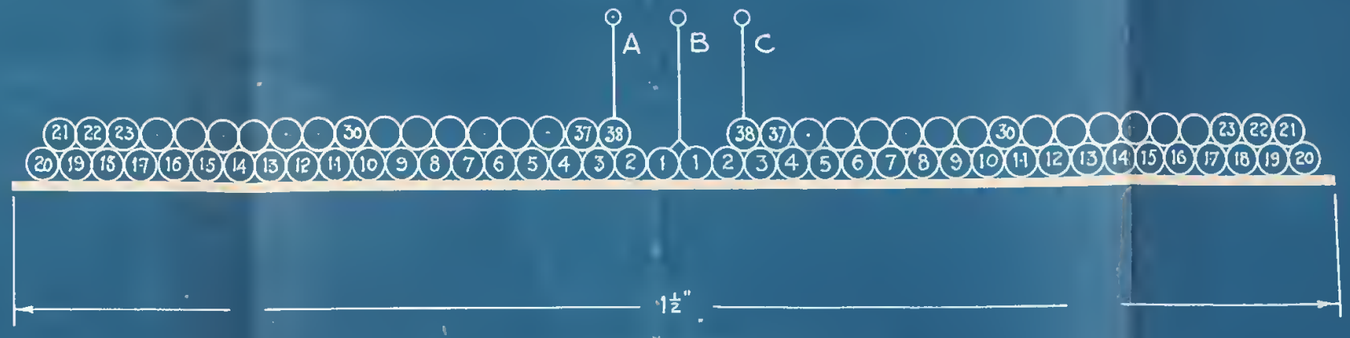


FIG. 9.

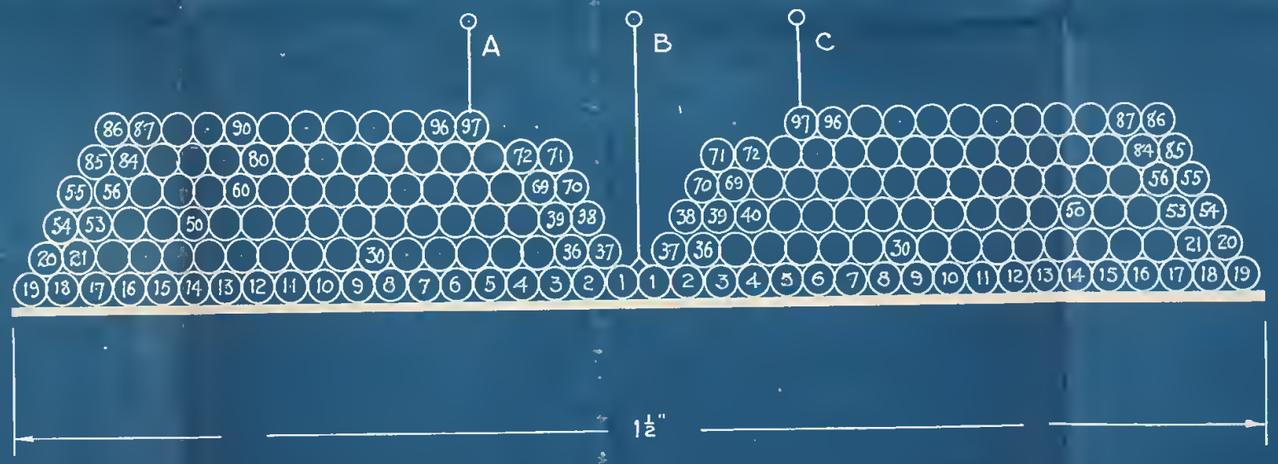
BUREAU OF STANDARDS WASHINGTON, D. C.	DRAWN J.C.J.	SCALE	AUXILIARY GENERATOR.
	TRACED J.C.J.	DATE Dec 3. 35	
	CHECKED	DRAWING NO. 1010-C	
DIVISION 1 SECTION 6	APPROVED	NO. SHEETS 5	SHEET NO. 3



2×38 TURNS IN SERIES, TWO LAYER WINDING, NO. 24. D.C.C. WIRE

COIL 4.

FIG. 10

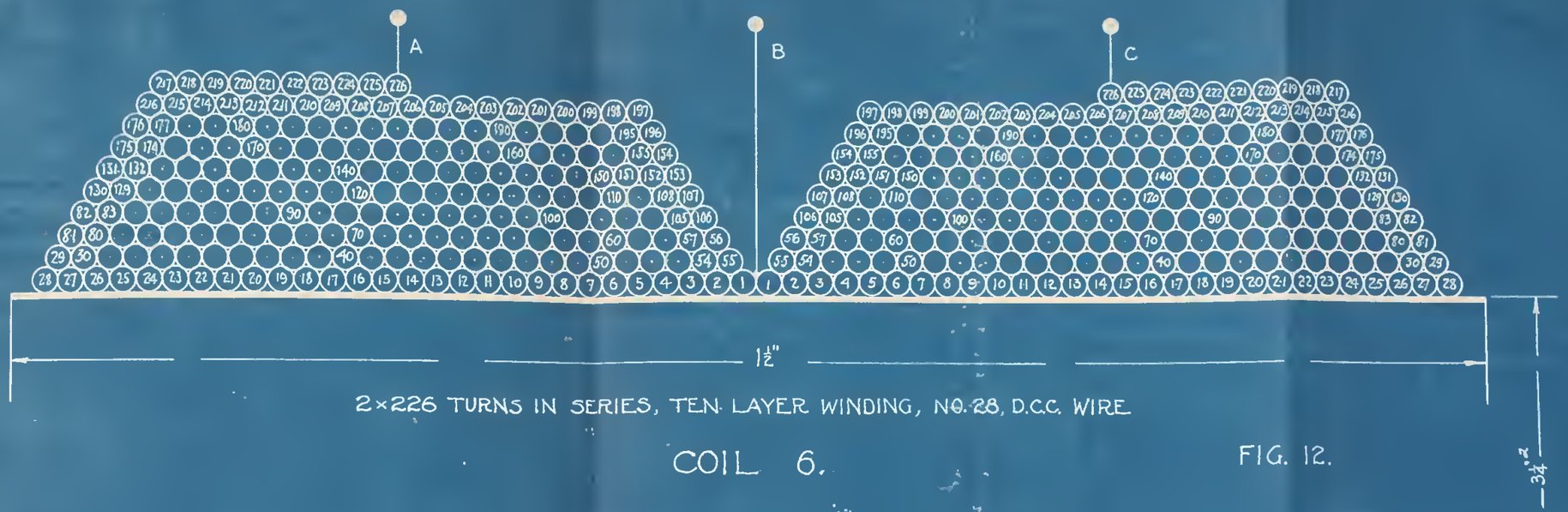


2×97 TURNS IN SERIES, SIX LAYER WINDING, NO. 24. D.C.C. WIRE.

COIL 5.

FIG. 11.

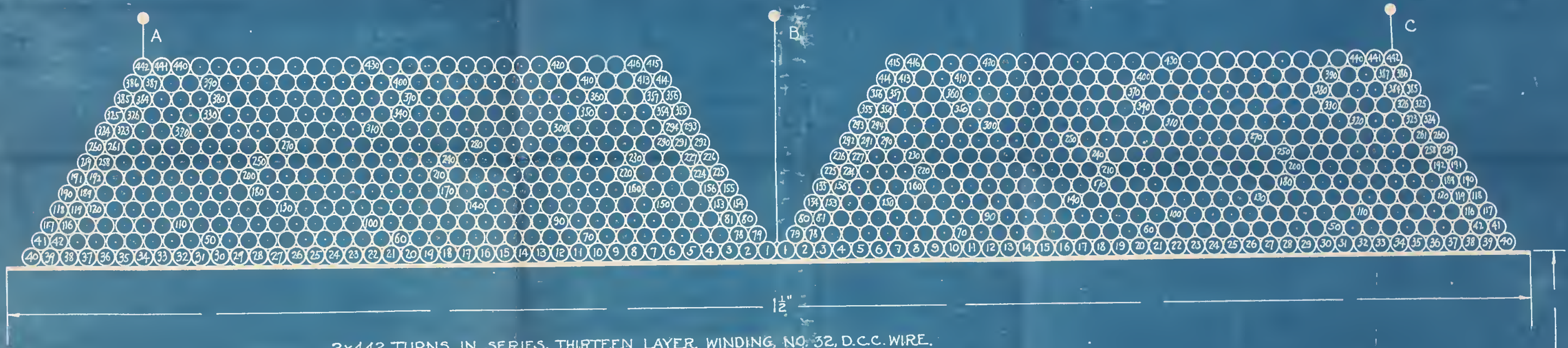
BUREAU OF STANDARDS WASHINGTON, D. C.	DRAWN L.C.C.	SCALE	AUXILIARY GENERATOR
	TRACED L.C.C.	DATE Dec 3. 25	
	CHECKED [illegible]	DRAWING NO. 1010-D	
DIVISION 1 SECTION 6	APPROVED [illegible]	NO. SHEETS 5	SHEET NO. 4



2×226 TURNS IN SERIES, TEN LAYER WINDING, NO. 28, D.C.C. WIRE

COIL 6.

FIG. 12.



2×442 TURNS IN SERIES, THIRTEEN LAYER WINDING, NO. 32, D.C.C. WIRE.

COIL 7.

FIG. 13.

BUREAU OF STANDARDS WASHINGTON. D. C.		DRAWN J.R.J.	SCALE	AUXILIARY GENERATOR.	
		TRACED J.R.J.	DATE Dec 9.25		
		CHECKED	DRAWING NO.		
DIVISION 1	SECTION 6	APPROVED Gitd	1010-E	NO. SHEETS 5	SHEET NO. 5